Reithrodontomys montanus.   By Kenneth T. Wilkins

Reithrodontomys montanus (Baird, 1855)

Plains Harvest Mouse

Reithrodon montanus Baird, 1855:335. Type locality ". . . vicinity of the Rocky Mountains, lat. 38°." Baird (1858:450) later indicated the type locality as "Rocky Mountains, 39°." Armstrong (1972) resolved this confusion and determined that the type locality should follow Allen (1895:124) as ". . . probably near the upper end of the San Luis Valley. . . ," Saguache Co., Colorado.

Reithrodontomys montanus: Allen, 1893:80; first use of current name combination.
Reithrodontomys albescens Cary, 1903:53. Type from 18 mi NW Kennedy, Cherry Co., Nebraska.
Reithrodontomys griseus Bailey, 1905:106. Type from San Antonio, Bexar Co., Texas.

CONTEXT AND CONTENT. Order Rodentia, Suborder Myomorpha, Family Muridae, Subfamily Sigmodontinae (Carleton and Musser, 1984), Genus *Reithrodontomys*, Subgenus *Reithrodontomys*. Hall (1981) recognized three subspecies:

R. m. albescens Cary, 1903:53, see above.
R. m. griseus Bailey, 1905:106, see above.
R. m. montanus (Baird, 1855:335), see above.

DIAGNOSIS. Keys to the species of *Reithrodontomys* were presented by Hall (1981), Hooper (1952), and Spencer and Cameron (1982). Upper incisors each possess a single longitudinal groove, a feature from which the generic name is derived. Dental formula of the genus is i 1/1, c 0/0, p 0/0, m 3/3, total 16. Molars are low crowned and rooted.

Sympatric congeners with which *R. montanus* can be confused are *R. humulis* and *R. megalotis*, both of which are also in the subgenus *Reithrodontomys*. *R. humulis* is smaller than *R. montanus*; average external measurements (in mm) for *R. humulis* (listed first) and *R. montanus* (Schmidly, 1983) are: total length, 107, 114; tail length, 47, 53; hindfoot length, 14, 15; ear length, 10, 11. Compared to *R. montanus*, *R. humulis* has more deeply pigmented dorsal pelage and has blackish monocolor ears lacking a bright preauricular tuft and postauricular spot. Distinct labial ridges often with cusplets on the first and second lower molars in *R. humulis* are either indistinct or absent in *R. montanus* (Hooper, 1952; Spencer and Cameron, 1982).

Reithrodontomys montanus and *R. megalotis* are similar in size, coloration, and cranial proportions, especially in the Great Plains region (Hooper, 1952). The tail is equal to or longer than the head and body in *R. megalotis*, whereas the tail is shorter than the head and body in *R. montanus*. The tail is more sharply bicolored in *R. montanus* (Schmidly, 1977). Breadth of braincase is less than or equal to 9.6 mm in *R. montanus*; in *R. megalotis*, the braincase is broader than 9.5 mm. These species also differ in molar features, best seen in the first two upper molars (Hooper, 1952); in *R. montanus*, cusps are shorter and the principal labial enamel folds are broad and long so that the primary cusps seem farther apart than in *R. megalotis*. In lateral profile, regions between paracone and anterocone and between paracone and metacone are U-shaped in *R. montanus* but V-shaped in *R. megalotis*.

GENERAL CHARACTERS. *Reithrodontomys montanus* is a small mouse with a prominent dark middorsal body stripe bounded laterally by lighter grayish fur having a peppered appearance (Fig. 1). Ventral body and hindfoot pelage is whitish. The tail is slender and abruptly bicolored, whitish below with the dorsum about as dark as the middorsal body stripe or intermediate to the darker middorsal body stripe and the lighter lateral body fur. Fur on the tail is sparse yet the tail does not appear scaly. One pair of

mammae is positioned pectorally and two pairs are inguinal. The soles of the hindfeet have six tubercles (Hall, 1981).

The skull of *R. montanus* (Fig. 2) possesses a foramen ovale, a small postglenoid foramen, and a large subsquamosal foramen (Carleton, 1980). The elongate sphenopalatine vacuities extend over half the length of the presphenoid. The lacrimal projection is not conspicuous and no postorbital process is present. Temporal ridges are absent. In dorsal view, the supraorbital region exhibits an hourglass shape. The malleus has a parallel configuration wherein its manubrium forms a right angle with its head, a broad lamina extends anteriorly from the union of the head and manubrium, and the orbicular apophysis is generally well developed. Hooper (1952) included photographs of dorsal and ventral views of the skull of *R. montanus*.

A summary of the ranges of external and cranial measurements (in mm) for samples of *R. montanus* of mixed sex and age from Colorado (Armstrong, 1972), Kansas (Smith, 1964), and Wyoming (Long, 1965) follows: total length, 54 to 146; tail length, 20 to 69; hindfoot length, 10 to 20; length of ear from notch, 4 to 16; greatest length of skull, 15.4 to 20.8; length of rostrum, 4.8 to 7.2; breadth of rostrum, 2.8 to 3.9; interorbital breadth, 2.8 to 3.4; zygomatic breadth, 8.5 to 10.9; cranial breadth, 8.5 to 10.7; alveolar length of maxillary toothrow, 2.9 to 3.6; length of incisive foramen, 3.0 to 4.5; length of palate, 2.5 to 3.7; depth of cranium, 6.2 to 8.2; and length of nasals, 6.2 to 7.5. Weights of five specimens from Colorado range from 9.7 g to 12.9 g with a mean of 10.9 g (Armstrong, 1972).

In reviewing the systematic status of *R. montanus*, Smith (1964) found that females were larger than males in standard external measurements and in 3 of 10 cranial measurements (i.e., rostral breadth, cranial breadth, length of incisive foramen). However, secondary sexual variation was not significantly different for any of the measured features.

Three age classes can be recognized on the bases of pelage and of molar eruption and wear (Smith, 1964). In juveniles, the third upper and lower molars have not erupted and the first and second molars show little or no wear. Third molars are erupted to the same level as other molars in subadults. Molar wear in subadults ranges from practically nonexistent to wear causing slight confluence on all cusps of the third molar. The third molars of adults are worn considerably with the width of confluent surfaces that connect cusps greater than in younger individuals.

DISTRIBUTION. The geographic distribution of the plains harvest mouse (Fig. 3) extends from southwestern South Dakota

FIG. 1.   Photograph of *Reithrodontomys montanus* from Fairfield, Freestone County, Texas (provided by John L. Tveten).
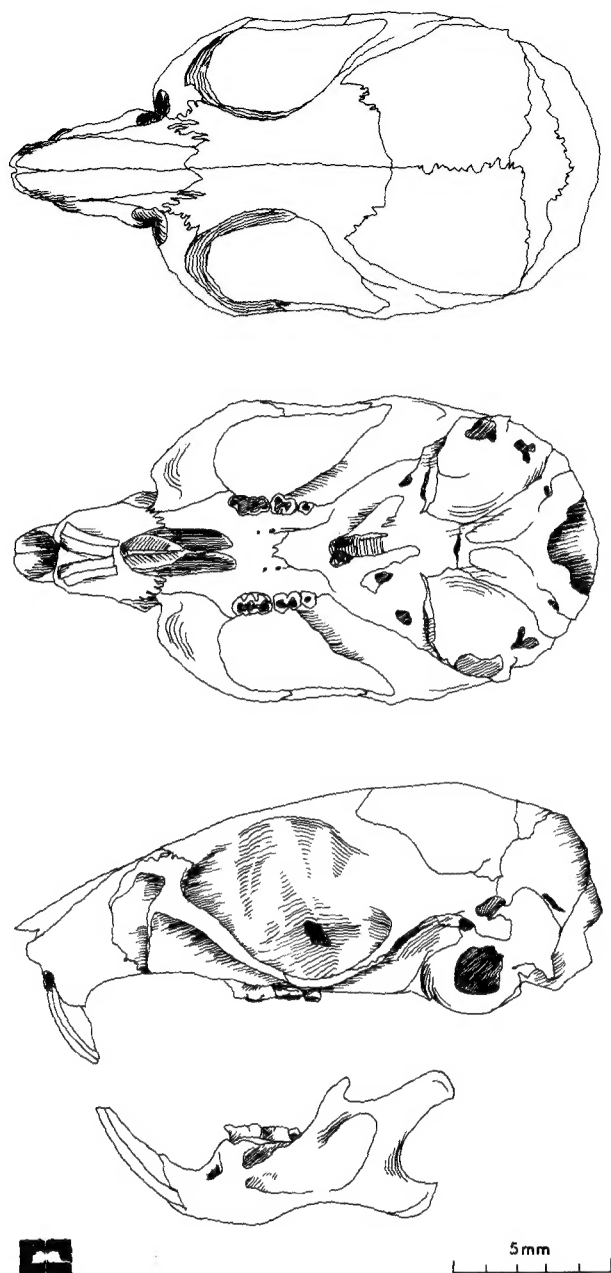
FIG. 2. Dorsal, ventral, and lateral views of cranium and lateral view of the mandible of *Reithrodontomys montanus* (TCWC 30336) from Madisonville, Madison County, Texas (drawings by Ellen Guelker).
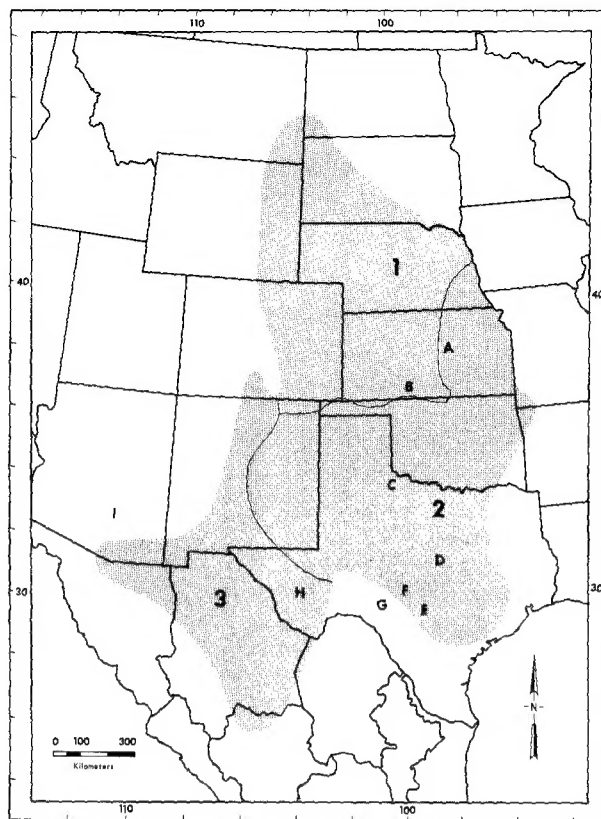

FIG. 3. Geographic distribution of the three subspecies of *Reithrodontomys montanus*: 1, *R. m. albescens*; 2, *R. m. griseus*, and 3, *R. m. montanus* (after Hall, 1981). Pleistocene records of *R. montanus* include (A) Sandahl, (B) Jinglebob, (C) Easley Ranch and Monument sites, (D) Longhorn Cavern, (E) Friesenhahn Cave, (F) Klein Cave, (G) Schulze Cave, (H) Fowlkes Cave, and (I) Deadman Cave.

and southeastern Wyoming southward through Nebraska, eastern Colorado, Kansas, Oklahoma, much of Texas and New Mexico, southeastern Arizona and into portions of the Mexican states of Sonora, Chihuahua, and Durango (Hall, 1981). Findley et al. (1975) speculated that the distribution of *R. montanus* in central and western New Mexico may be patchy and discontinuous. Schmidly (1983) suspected that the species currently may be extending its range eastward into the more forested parts of eastern Texas via "prairies" along highways and other rights-of-way.

Reithrodontomys montanus may be found through a broad range of elevations, from about 84 m in east-central Texas (Madison Co.; Wilkins et al., 1979) to at least 1,585 m in the Davis Mountains, in western Texas (Schmidly, 1977), at least 1,707 m near Fort Collins, Colorado (Armstrong, 1972), and at least 1,920 m near Canutillo, Durango, Mexico (Hall, 1981).

FOSSIL RECORD. *Reithrodontomys montanus* is a member of at least 10 Pleistocene faunas (Fig. 3), all located within or

near the modern range of the species (Kurtén and Anderson, 1980). The earliest record for *R. montanus* is the late Irvingtonian Sandahl deposit in McPherson Co., Kansas (Semken, 1966). The other records are of Rancholabrean or younger age, including the Sangamonian Easley Ranch and Monument local faunas (Foard Co., Texas; Dalquest, 1962) and the late Sangamonian-early Wisconsinan Jinglebob local fauna (Meade Co., Kansas; Hibbard, 1955; Zakrzewski, 1975) and five younger deposits in Texas: Fowlkes Cave (late Pleistocene; Culberson Co.; Dalquest and Stangl, 1984); Longhorn Cavern (late Wisconsinan; Burnet Co.; Lundelius, 1967), Schulze Cave (latest Wisconsinan; Edwards Co.; Dalquest et al., 1969); Friesenhahn Cave (late Wisconsinan-early Holocene; Bexar Co.; Graham, 1976), and Klein Cave (Holocene; Kerr Co.; Roth, 1972). This species also has been reported from Deadman Cave (late Wisconsinan-early Holocene; Pima Co., Arizona; Mead et al., 1984). The Schulze Cave and Fowlkes Cave faunas included *R. fulvescens* and *R. megalotis* in addition to *R. montanus*.

FORM AND FUNCTION. The entoglossal process of the hyoid apparatus is a small knob (illustrated by Sprague, 1941). The basihyal is arched. The thyrohyal is long and of equal or greater length than the basihyal (Carleton, 1980). Except for their smaller size, hyoids in the genus *Reithrodontomys* resemble those of *Peromyscus maniculatus* (Sprague, 1941). The shape of the ceratohyals in *R. montanus* is much like that in *Baiomys taylori* (Sprague, 1941). Unlike *B. taylori*, however, *Reithrodontomys* hyoids possess an entoglossal process (Carleton, 1980).

Carleton (1980) provided the following descriptions of parts of the postcranial skeleton of *R. montanus*. The humerus lacks an entepicondylar foramen above the medial epicondyle. The tibia and fibula are fused along more than 42% of the tibial length. The vertebral column in *R. montanus* is 7C, 13T, 6L, and 26 to 31 Ca, total 52 to 57. A spine is present on the second thoracic

vertebra. The first rib articulates with both the seventh cervical and first thoracic vertebrae.

The soft palate of *R. montanus* exhibits two complete and five incomplete transverse ridges (Carleton, 1980). A sulcus is not present on the greater curvature of the stomach (Carleton, 1973). This species lacks a gall bladder. The caecum is moderately long and is simple internally.

Morphology of the glans penis and baculum places the genus *Reithrodontomys* within the peromyscine subdivision of North American rodents belonging to the "simple-glans" group (Hooper and Musser, 1964). The entire body of the glans is invested with spines although spines are absent from the internal crater wall (Carleton, 1980). The body surface is not corrugated and the urinary meatus is positioned terminally or nearly so (Carleton, 1980). The glans lacks dorsal lappets, ventral lappets, a urethral process, a dorsal papilla, lateral bacular mounds, a crater hood, and a ventral shield (Carleton, 1980). The glans is about 4 to 6 times longer than wide (Carleton, 1980). The baculum (illustrated by Burt, 1960) is 5 to 8 times longer than wide and is longer than the glans. The single cartilaginous tip of the baculum composes less than 10% of the length of the baculum (Carleton, 1980).

Bulbourethral glands of normal size are present in *R. montanus* (Carleton, 1980). Vesicular glands are shaped like an inverted J. Ampullary and prostate glands are present and are of the non-elaborate condition. *R. montanus* lacks preputial glands and ampullae at the base of the ductus deferens.

ONTOGENY AND REPRODUCTION.
The gestation period for plains harvest mice in Texas is approximately 21 days (Davis, 1974; Schmidly, 1983). A female raised in captivity gave birth to her first litter at an age of 85 days; intervals between her successive litters ranged from 21 to 27 days (Leraas, 1938). Reported litter sizes and embryo counts range from one to nine with mean litter size of about four (Davis, 1974; Goertz, 1963; Hall, 1955; Schmidly, 1983; Smith, 1964). In specimens from throughout the range, Smith (1964) noted crown-to-rump lengths ranging from 2 to 24 mm. Crown-to-rump length was 22 mm for five embryos from a female captured during October in Ellis Co., Kansas (Choate and Fleharty, 1975). Gravid females were collected in Kansas during all months except December and January (Brown, 1946). Female *R. montanus* are polyestrous and probably breed throughout the warmer months, including March, June, and July, in Nebraska (Jones, 1964). In more southerly parts of their range, *R. montanus* probably breed year-round. In material studied by Smith (1964), pregnant females were found for every month of the year. In Payne Co., Oklahoma, pregnant females were taken in February, May, June, July, and November (Goertz, 1963). Goertz (1963) reported lactating females and scrotal males during all months except August, September, and October, a period when no *R. montanus* were collected in that study. Testis dimensions range from 3 to 6 mm with a mean of 4.2 mm (Goertz, 1963). The sex ratio of trapped plains harvest mice from this same Oklahoma study was 1:1.3 in favor of males (53 males : 41 females). Year-round breeding also is suggested for Texas populations by capture of scrotal males in January and April, of pregnant females in January and October, and of lactating females in March (Davis, 1974; Schmidly, 1983). Waggoner (1975) reported a 1:1 sex ratio in Freestone Co., east central Texas.

Neonates are altricial, weigh about 1 g, and are blind and naked. The newborn are well haired in 6 days. After 8 days the eyes are open. Weaning occurs at about 14 days with adult size attained by about 5 weeks. Sexual maturity occurs at about 2 months of age (Davis, 1974; Leraas, 1938; Schmidly, 1983). Adult size and pelage are attained at 5 weeks (Leraas, 1938). *R. montanus* acquires three distinct pelages in reaching adulthood (Smith, 1964). The juvenile pelage is duller in color than subadult and adult pelages. Juvenile hair is distributed sparsely and is curly so that the fur has a cottony texture. The sheen characteristic of adult pelage is lacking in subadults whose hair is not as dense as in adults. The molt from subadult to adult pelage begins on the venter and progresses antero-posteriorly and dorsally. Hair length is greater during winter (11 to 12 mm middorsally) than during summer (6 to 7 mm).

The lifespan of *R. montanus* is unknown although individuals in mark-recapture studies have been followed as long as 154 days in Oklahoma (Goertz, 1963) and 14 months in Freestone Co., Texas (Waggoner, 1975).

ECOLOGY.
Most habitats in which *R. montanus* has been collected may be described as "open grassy areas" (Goertz, 1963). Such grassy areas include ruderal situations such as (1) old hay fields in Arkansas planted to fescue (*Festuca*) and bermuda grass (*Cynodon*) but subsequently invaded by broomsedge (*Andropogon virginicus*), Johnson grass (*Sorghum halepense*), foxtail (*Alopecurus*), and other grasses (Sealander, 1979); (2) moderately grazed pastures and interstate highway medians with sparse to moderate stands of little bluestem (*Schizachryium scoparium*) and paspalum (*Paspalum*) in east Texas (Wilkins et al., 1979); (3) cultivated fields of new wheat and grain sorghum in west-central Kansas (Navo and Fleharty, 1983); (4) disturbed unirrigated waste areas adjacent to, but not in, cornfields in western Kansas (Fleharty and Navo, 1983); (5) grazed sand sagebrush habitat characterized by sand sagebrush (*Artemesia filifolia*) and blue grama (*Bouteloua gracilis*) in eastern Colorado (Moulton et al., 1981); (6) grazed riparian woodland dominated by plains cottonwood (*Populus sargentii*), blue grama, sideoats grama (*B. curtipendula*) and switch grass (*Panicum virgatum*) in eastern Colorado (Moulton et al., 1981); (7) moderately and heavily grazed grasslands in north-central Oklahoma (Schnell et al., 1980); (8) reclaimed lignite strip-mining areas planted to crimson clover (*Trifolium incarnatum*) and coastal bermuda in east-central Texas (Waggoner, 1975); and (9) abandoned grassy fields in east-central Texas (Waggoner, 1975). Abundances of *R. montanus* in these habitats ranged from 0.0004 to 8.1/1000 trapnights and densities to 1.5/ha.

In Kansas, *R. montanus* in six types of mixed prairie habitat ranging from grazed to natural conditions attained a density of approximately 6.8/ha (Brown, 1946). Kansas *R. montanus* inhabit principally areas of short grass and prickly pear (*Opuntia*) (Hall, 1955). In north-central Kansas (Kaufman and Fleharty, 1974), this species is found in greatest abundance in the short grass association of three awn (*Aristida fenderiana*) and bristlegrass (*Setaria*); second greatest densities occurred in a short grass situation characterized by blue grama, sand dropseed (*Sporobolus*), and buffalo grass (*Buchloe dactyloides*). The big (*Andropogon gerardii*) and little bluestem-grama tall grass showed the lowest densities, whereas no *R. montanus* were captured in sandy, ungrazed dropseed-bluestem settings and riparian habitats. Fleharty and Navo (1983) considered western Kansas sandsage prairie, dominated by blue grama, sand sagebrush, and prickly pear, to be marginal habitat because of low numbers of *R. montanus* caught (0 to 5.4/1,000 trapnights). Other situations in Kansas where *R. montanus* have been taken include prickly pear clusters, along edges of sunflower (*Helianthus*)-tall grass areas, and in dead Russian thistles (*Cirsium*) (Hill and Hibbard, 1943).

Relative abundance of *R. montanus* in eastern Colorado was greatest in ungrazed short grass prairies featuring buffalo grass, blue grama, and broomweed (*Xanthocephalum sarothrae*) (Moulton et al., 1981). Plant communities used by *R. montanus* in eastern Wyoming, from greatest to least abundance, are: prairie sand reed (*Calamovilfa longifolia*)—grama (10.2/1,000 trapnights); grama-needle and thread grass (*Stipa comata*; 5.6); grama-needle and thread-three awn (3.6); grama-buffalo (1.9); and sage-grass (0.6; Maxwell and Brown, 1968). No *R. montanus* were caught in yucca-grass or sand dune associations (Maxwell and Brown, 1968). In Nebraska, *R. montanus* "seemingly lives exclusively in upland habitats" such as sand hills and dry, open fields and prairies (Jones, 1964). These mice have been trapped in sumac (*Rhus glabra*)-grama and grama-beardgrass (*Andropogon saccharoides*) associations in northeastern Oklahoma (Blair, 1938) and in short and midgrass prairies, especially in well-developed grasses in floodplains in New Mexico (Findley et al., 1975). In Texas, *R. montanus* occurs most often in climax (or near climax), well-drained grasslands. In Brazos Co., eastern Texas, the species is most common in blackland prairies dominated by bluestems (Davis, 1974; Schmidly, 1983). *R. montanus* inhabits the short-grass association in the Davis Mountains of Trans-Pecos Texas (Blair, 1940).

Ecological distribution of *R. montanus* in eastern Wyoming correlates with structural components of habitat (Maxwell and Brown, 1968). This species is most abundant in situations where vegetation height is 2.5 to 25 cm, although they also are found in taller vegetation in lesser abundance. *R. montanus* densities are greater where the amount of bare soil surface is less than 40%. Additionally, these mice occur in greater numbers in areas having a loamy sand soil although they occur in lesser abundance in association with other soil types (sandy loam, loam, and sand). In situations (such

as Payne Co., Oklahoma; Goertz, 1963) where *R. montanus* and *R. fulvescens* are sympatric, *R. montanus* occurs in areas of shorter and less dense vegetative cover (183 to 254 mm and 63%; but 276 mm and 83% for *R. fulvescens*).

Waggoner (1975) reported three species of *Reithrodontomys* to co-occur in an abandoned field in Freestone Co., east-central Texas. The two smaller species (*R. montanus* and *R. humulis*) were trapped in greater numbers in areas of lighter plant cover than in areas of taller grasses. *R. fulvescens* occurred in all parts of the field (Schmidly, 1983).

Waggoner (1975) found home ranges of *R. montanus* in Freestone Co., Texas, as small as 0.23 ha and as large as 0.84 ha. In Payne Co., Oklahoma, "homestead areas" for males ranged from 0.04 to 0.45 ha with a mean of 0.17 ha and for females from 0.04 to 0.4 ha with a mean of 0.21 ha (Goertz, 1963). Goertz (1963) followed movements of individuals in his mark-recapture study; the greatest distance travelled by a male was 185 m over a period of 154 days and by a female was 181 m in 76 days. In a study of road-crossing activity of rodents along several southeastern Texas highways, no marked *R. montanus* were recaptured on opposite sides of the roadways (Wilkins, 1982).

Reithrodontomys montanus is insectivorous and herbivorous. The bulk of the diet of plains harvest mice in Kansas consists of grasshoppers and seeds of buffalo grass and switch grass (Brown, 1946). Other plants contributing to their diet in this same study were Indian grass (*Sorghastrum nutans*), crowns of blue grama, cactus fruit, and seeds and flower heads of broomweed, ironweed (*Veronia interior*), snow-on-the-mountain (*Euphorbia marginata*), and Maxmilian sunflower (*Helianthus maxmiliani*).

Nests of plains harvest mice described from Texas and Kansas generally consist of grasses compacted into small balls (Brown, 1946; Davis, 1974). Smith (1964) noted that nests were globular with an opening at one end; nest dimensions were 10 to 11 cm by 6 to 7 cm. These nests usually are suspended a few centimeters from the ground in taller grasses or in bunch grass or they may be located on the ground surface or within tin cans and other objects on or near the ground. In Anderson Co., Kansas, nests also have been found beneath logs and discarded lumber (Smith, 1964). Grasses composing nests studied in Kansas include big bluestem, little bluestem, blue grama, and side-oats grama. Plants used as inner linings of such nests are sand dropseed, pappus from low milkweed (*Asclepias pumila*), and wavy-leafed thistle (*Cirsium undulatum*). In Oklahoma, a nest located beneath a small limestone slab was made largely of cotton probably scavenged from a nearby shack (Blair, 1938).

Little information is available concerning predators of *R. montanus*, although they surely contribute to the diets of numerous mammalian carnivores, snakes, and raptors. Because of the skeletal similarity of various species of *Reithrodontomys*, analyses of owl pellets from areas of sympatry of two or more *Reithrodontomys* species rarely listed material identified to the species level (e.g., Anderson and Ogilvie, 1957; Czaplewski, 1976; Marti, 1969). However, harvest mice contributing to the diet of barn owls (*Tyto alba*) in Wheeler Co. in the Texas panhandle provisionally were identified as *R. montanus griseus* (Stickel and Stickel, 1948).

Plains harvest mice occur in association with several other rodent species: *Spermophilus tridecemlineatus, S. spilosoma, Perognathus flavescens, P. flavus, P. hispidus, Dipodomys ordii, Reithrodontomys megalotis, R. fulvescens, Peromyscus maniculatus, P. leucopus, Baiomys taylori, Onychomys leucogaster, Sigmodon hispidus, Neotoma floridana, Microtus ochrogaster,* and *Mus musculus* (Brown, 1946; Goertz, 1963; Kaufman and Fleharty, 1974; Moulton et al., 1981; Navo and Fleharty, 1983; Schnell et al., 1980; Wilkins, 1977; Wilkins and Schmidly, 1980). In none of these studies was *R. montanus* the most abundant species in the rodent community. More often, trapping indicated *R. montanus* to be the least abundant member of the rodent community.

Although other species of *Reithrodontomys* have been documented as hosts for various internal and external parasites (Doran, 1954, 1955; Whitaker and Wilson, 1974), *R. montanus* seemingly has not been examined for parasites.

GENETICS. The karyotype of *R. montanus* generally has a diploid number of 38 and a fundamental number of 72; all autosomes are biarmed. Karyotypes are published in Robbins and Baker (1980) and Robbins (1981). G- and C-banding of chromosomes of several *Reithrodontomys* species indicated that at least 21 events including inversions, translocations, and heterochromatic additions were required to derive the *R. montanus* karyotype (by karyotypic megaevolution; Baker and Bickham, 1980) from that of *R. fulvescens*, a species that is karyotypically and morphologically intermediate to the two subgenera, *Aporodon* and *Reithrodontomys* (Robbins and Baker, 1980). Robbins (1981) reported a female (2n = 39, FN = 72 or 74) possessed an X-chromosome of reduced size and an extra chromosome possibly derived from the heterochromatic portion of the X-chromosome. Variation also occurred in males with some individuals having an acrocentric Y-chromosome and others having short arms present on the Y-chromosome. The phylogenetic relationships within the genus have not been elucidated by chromosomal or electrophoretic studies (Arnold et al., 1983). However, Hood et al. (1984) and Nelson et al. (1984), by using karyology and electrophoresis, respectively, provided evidence that *R. raviventris* is related more closely to *R. montanus* than to *R. megalotis*.

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K. T. WILKINS, DEPARTMENT OF BIOLOGY, BAYLOR UNIVERSITY, WACO, TEXAS 76798.